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Investigating the Presence of BPA in Infant Oral Hygiene Products Using Fluorescence Spectroscopy

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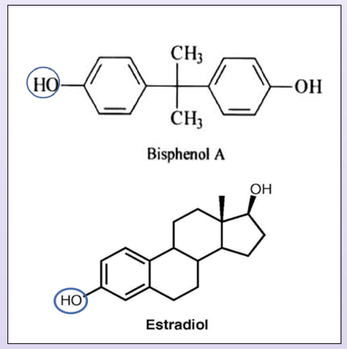
Abstract:

- Bisphenol-A (BPA) is a chemical found in hard plastics.
- BPA is an endocrine disruptor that binds to estrogen receptors. This is linked to negative health effects such as cardiovascular diseases and developmental issues.



- Infants and young children are more at risk to these effects because their endocrine systems are not fully developed.
- For this project, toothbrushes were investigated to determine if they contained BPA.
- Toothbrushes were further studied to determine If the BPA was primarily located in the bristles or heads.
- BPA is a fluorescent compound with an excitation wavelength of 278 nm and an emission wavelength of 304 nm, so a FS-5 spectrofluorometer from Edinburgh Instruments was used to determine the presence of BPA in each sample.

Materials and Methods:

- A variety of children's toothbrushes, labeled A-H, were selected and tested for the presence of BPA.
- Each toothbrush was placed in 100 mL of a 1:1 methanol:water (M/W) solution at room temperature.
- A 5-mL aliquot of the solution was taken at time intervals ranging from 5 minutes to 1 week after the toothbrush was placed in the solution.
- Each sample was run in the spectrofluorometer in duplicate, where the emission and excitation intensities were reviewed and recorded to determine which toothbrushes contain BPA.

Materials and Methods, Continued:

- The bristles were removed from the BPA-containing toothbrushes.
- The bristles and the head of each toothbrush were then placed separately into 100-mL solutions of 1:1 M/W and analyzed following the protocol described above.
- Values were compared to determine the location of BPA in the toothbrushes.

Results:

Figure 1

Fluorescence Excitation and Emission peaks from the calibration curve of BPA in 1:1 M/W

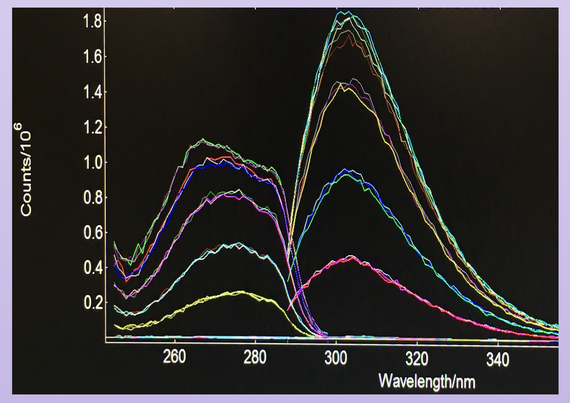


Figure 2

Fluorescence Emission Calibration Curve for BPA

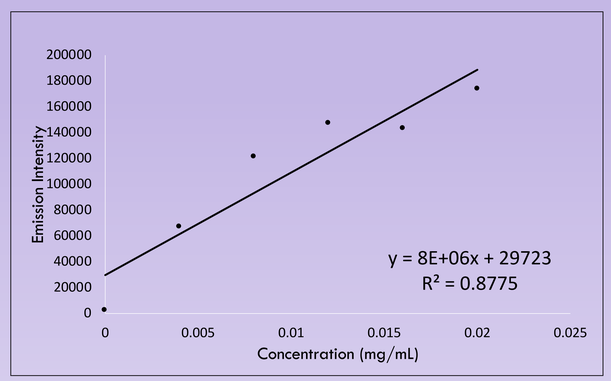


Figure 3

Fluorescence Emission Intensities of Toothbrush H and Toothbrush B over time

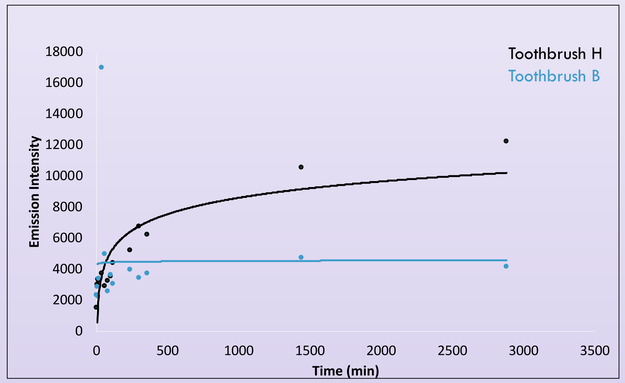
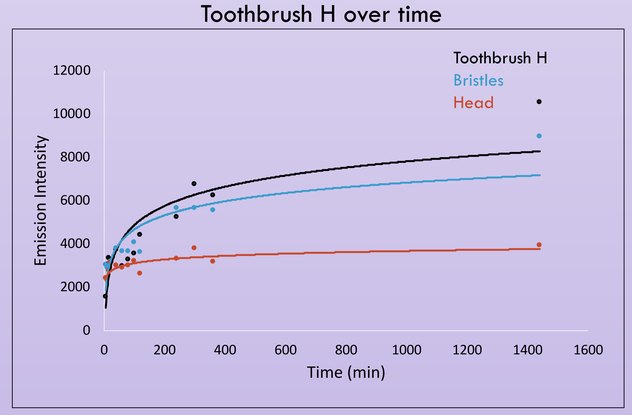


Figure 4

Fluorescence Emission Intensities of Components of Toothbrush H over time



Conclusions:

- After reviewing the data it appeared as though toothbrushes F and H contained traces of BPA. Neither of these toothbrushes were labeled as BPA free.
- There did not appear to be a distinct difference between the other unlabeled toothbrushes (A, B, E, G) and the toothbrushes that were labeled BPA free (C and D).
- Based upon the toothbrush isolation data, it appeared that the bulk of the BPA was located in the bristles of the toothbrush.

Future Work:

- Perform additional comparisons on toothbrush bristles and heads to determine the location of BPA in the toothbrushes.
- Perform statistical analysis to improve the accuracy of the conclusions made.
- Extend the testing period to improve the results in order to discover the full amount of BPA in each toothbrush.

References:

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- Nordqvist, Christian. "Bisphenol A: Hazards and Sources." *Medical News Today*, MediLexicon International, 25 May 2017
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